THE OHIO STATE UNIVERSITY
Max M. Fisher College of Business
Columbus, Ohio

An Experimental Test of Quasi-Rational Economic Behavior

By
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To Mom and Dad

Their love and support let me believe in myself...

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Objective

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Education

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- Finance and Economics, candidate for graduation with Distinction in Economics, with Honors in Business Administration, Summa Cum Laude
- Major GPA: 3.98 Overall GPA: 3.89

Honors received

Ohio State University Outstanding Senior Award 98, Pace Setter College of Business Outstanding Male Senior Award 98, Sphinx Senior Honorary 97; Phi Kappa Phi Honor Society 97; Beta Gamma Sigma Honor Society 97; Pace Setter Award 97; Financial Executives Institute Award 97; Undergraduate Research Scholarship 97; Phi Eta Sigma Scholarship 97; Max Fisher College of Business Academic Scholarship 96, 97; Mortar Board Alumni Scholarship 96,97; Golden Key National Honor Society 96, President's Salute to Academic Achievement 96, Bucket & Dipper Junior Honorary 96; Alpha Lambda Delta & Phi Eta Sigma Freshman Honor Societies 95

Extracurricular activities

Sphinx Honorary President 97-98; Student Government Treasurer 97-98; Pace Setter Club Vice President 97-98; Council on Student Affairs Allocation Committee Chairperson 97-98; Committee on Academic Misconduct 95-98; Honors Ambassador 96-98; Bucket & Dipper Honorary Secretary 96-97; Student Government Judicial Panel 96-97; Class Honorary President 95-96

Work experience

6/97-9/97, 12/97 **The B.F. Goodrich Company** Cleveland, Ohio

Legal/Finance Associate (full time)

- Work on contracts and closing documents for the sale of a division, analyze relevance of accrual for product warranty program, correct errors in accounting system; extensive travel

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Junior Market Analyst (full time)

- Complete and present market studies for thermoplastic division, attend UL® compliance seminar

11/96-3/97 **Business Technology Center** Columbus, Ohio

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6/95-9/95, 12/95 **National City Bank Consumer Loan Services** Cleveland, Ohio

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Computer skills

Microsoft Operating Systems (NT, 95), Office Suite; Novell Office Suite; internet browsers; Lexis/Nexis database; Pascal programming

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Chapter 1: The Rationality Paradigm and Prospect Theory

Empirical research in experimental economics has produced a series of results that have brought the rationality paradigm of economic theory into question. The rationality paradigm predicts a consistent pattern of individual behavior in the evaluation of prospects and trades. However, studies in experimental economics find recurring and systematic inconsistencies in evaluations of prospects and trades. These recurring and systematic inconsistencies undermine the rationality paradigm that predicts systematic, optimizing behavior. A 1979 study by Kahneman and Tversky introduced an alternative descriptive model of economic behavior that they call "prospect theory." Kahneman and Tversky find divergent valuation in the coding of gains and losses of equal magnitude. Their studies led to the development of prospect theory to describe and predict decision behavior; prospect theory does not rely on a rigid pattern of optimizing behavior.

Kahneman and Taversky's presentation of the prospect theory model begins with a series of survey questions that highlight divergences in human behavior and expected utility theory.

These surveys evidence the systematic manner in which human behavior is dictated by factors such as framing effect, that is, externalities not relevant in typical economic incremental analysis and the rationality paradigm. The notion of framing effects of interest to this study is not that of the "half empty, half full" understanding of the proverbial water glass. The framing effects of interest are prior period outcomes of economic decision making, initial wealth position, and ownership entitlements.

In the context of the K&T surveys, the framing effects utilized include the use of different prior period outcomes applied to current prospects, and varying initial reference position, that is, ownership or prospective ownership of a good's value. The results gathered from these surveys indicated a systematic pattern of human behavior relative to framing effects quite different to that predicted by expected utility theory; K&T concluded this behavior could be described by a function relating relative gains and losses to value. K&T call this the "value function."

The value function is a modification of the expected utility function, with the objective probabilities being replaced by subjective decision weights. In addition, the value function does not consider absolute wealth in valuing prospects, but a subjective reference position that changes based on the particular prospect being considered. The value function, V, is defined over changes in wealth rather than final asset position. For "regular" prospects (i.e. $p + q < 1$ or $x \geq 0 \geq y$ or $y \geq 0 \geq x$) then the value of a prospect is given by

$$V(x, p; y, q) = \pi(p)v(x) + \pi(q)v(y)$$

If $p + q = 1$ and either $x > y > 0$ or $x < y < 0$ then

$$V(x, p; y, q) = v(y) + \pi(p)[v(x) - v(y)]$$

Where V is the value of the prospect being considered, v is the value of a potential outcome of that prospect, p and q are probabilities, x and y are the possible outcomes, and π is the subjective decision weight replacing the objective probability of expected utility theory.

The value function has three key features, each contributing to its richness and scope. First, the value function measures losses and gains relative to a natural reference point, contrasting with the use of consumption or wealth in expected utility theory. Measurement relative to a variant natural reference point accounts for the consequences of "framing effects," which are externalities that often produce sub-optimal decision making.

Second, the shape of the value function is concave for gains and convex for losses. This feature manifests itself in that large percentage changes in value are coded as being of more significance than smaller percentage changes in value—even if the changes are of equal absolute magnitude. The value function shape is in part based on the psychoanalytic principal that the difference between 0 and 100 seems greater than the difference between 1000 and 1100, regardless of the magnitude sign. The value function shape gives a graphical representation of the K&T finding that economic decisions favor risk seeking choices when evaluating two losses (choose the less probable, but higher expected value loss), and risk aversion when evaluating two gains (choose the more probable, but lower expected value gain).

The third feature is that the value function for losses is more steeply sloped than the value function for gains; this is referred to as "loss aversion"—that is, losses are weighted substantially more (in terms of value) than gains of equal magnitude. The disutility associated with the loss of x dollars being greater than the utility associated with the winning of x dollars is unique and represents the divergent coding of losses and gains that is central to prospect theory (Thaler, 1980).

The implications of this divergent theory are far reaching and allow for the development of an analytical framework to study the many anomalies that pervade experimental economics. The framework of prospect theory can be used to better understand the manner in which economic decisions are made. For instance, if prior period gains and losses affect decision making, an analysis of prior period gains and losses would be useful in the development of a forecasting model of economic decision making. Another example is that if value does change based upon the existence of ownership rights, is market value, which is determined by buyers and sellers, a true measure of inherent value? This latter issue is of particular importance to issues such as determining the fair compensatory value in eminent domain cases.

Chapter 2: Implications of Prospect Theory

The implications of prospect theory and the value function are best appreciated when related to specific examples where prospect theory can accurately explain consistent quasi-rational behavior. One such example is how prior period gains and losses affect risk taking behavior (Thaler and Johnson, 1990). The traditional views of disciplines such as economics and decision science advise that only incremental future costs are relevant in the evaluation of prospects and trades. However, empirical evidence indicates the effect of sunk costs (and "sunk gains") to influence behavior (Laughhunn and Payne, 1984). In the prospect theory framework, sunk costs are classified as losses due to the separate coding of the two sides of an exchange or transaction. That is, the value given up is viewed as one event and the value gained as another unique event (this is called segregation of gains and losses). Regardless of the compensation received in an exchange, the value sacrificed is coded as a loss when viewed in isolation. Laughhunn and Payne (1984) recognize that most decision makers are affected by prior outcomes.

The Effect of Prior Period Gains: "The House Money Effect"

Thaler and Johnson (1990) went further and examined the manner in which the framing effect of prior gains and losses affects decisions under uncertainty. Thaler and Johnson (1990) hypothesized that not only do prior gains and losses dramatically influence subsequent period choices, but they do so in systematic ways. Kahneman and Tversky (1979) found that in some situations that prior outcomes influence the expectation or aspiration level unrelated to the current status quo. These situations occur when evaluations of current prospects and trades affect the reference point established by a related act (that is, winning $100 on your first bet in a casino will elicit more risky behavior than one would otherwise engage in. If your stock market

portfolio gains $100 in value and then you go to the casino, this more risky behavior would not be observed.). This is referred to as the "house money" effect.

While the convex shape of the value function over the domain of losses predicts risk-seeking behavior in the domain for losses, certain empirical evidence suggests otherwise. One explanation for this departure from risk seeking behavior over the domain of losses is that prior period losses are not integrated in evaluating prospects and trades when the risky alternative does not offer the chance to break even (given the amount of the prior period loss). While certain empirical evidence questions the descriptive accuracy of the value function, there are many examples of support for the value function. An example of the descriptive accuracy of the value function is the observation of risk seeking behavior over the domain for losses when prior period losses are integrated with current period prospects. This tends to occur when the prospect allows for the potential to break even—offsetting prior losses with a gain of equal magnitude. The tendency to accept "break even" prospects over the domain of losses is explained by the strong preference to return to one's originally established reference point. The strong preference to remain at or return to one's originally established reference point is referred to as a "status-quo bias."

The value function describes a prior period gain as resulting in more risk-seeking behavior. A higher degree of risk tolerance is exhibited when current period losses are integrated with prior gains, particularly when the prior gain is larger than the potential loss. The assessment of gains and losses relative to the reference point associated with a large prior period gain offsets the manifestation of loss aversion and expands the degree of risk-seeking behavior in the domain of large prior period gains (Thaler and Johnson 1990).

The Endowment Effect

In addition to offering an explanation for the house money effect and loss aversion, prospect theory also offers an explanation for inconsistencies in divergent buying and selling prices, the existence of the endowment effect, and the evaluation of opportunity and sunk costs. Each of these phenomena is considered anomalous in light of the rationality paradigm of economic theory. However, empirical evidence supports the existence of each of these three phenomena, and prospect theory can predict why these "anomalies" persist.

Neoclassical economic theory assumes that an individual's maximum willingness to pay for a good (WTP) and minimum compensation demanded for the same good (WTA) should be negligible when income effects are small (Kahneman, Knetsch, and Thaler, 1990). However, empirical observations provide evidence contradicting this maxim. Thaler (1980) found that the minimal compensation demanded for accepting a .001 risk of death (WTA) was significantly higher (by more than an order of magnitude difference!) than the maximum amount the same individual was willing to pay to eliminate the same .001 risk of death (WTP).

Possible causes underlying this situation include the demand for tremendous compensation for agreeing to the loss of a public good (Rowe 1980). Bargaining habits also contribute to divergent buying and selling prices, as it is typical for a seller to offer high and a buyer to begin bargaining by bidding low. Even when misstating an individual's true valuation offers no advantage, such as answering hypothetical questions or single bid/offer markets, individuals are susceptible to this bargaining bias. This cause of the buying-selling discrepancy is viewed as a strategic mistake, which an experienced individual will learn to avoid over time (Coursey, Hovis and Schultz, 1987; Brookshire and Coursey, 1987).

The possible cause of the WTA/WTP differences that is of interest for present purposes is the existence of different reference positions affecting preferences, and not force of habit

mistakes (Thaler, 1980). Thaler labels the phenomena of the assignment of increased value to a good once that good has become part of an individual's personal endowment the "endowment effect." The endowment effect represents a manifestation of the loss aversion characteristic of prospect theory. This asymmetry implies that the act of selling a good is viewed as a loss and the acquisition of a good is viewed as a gain. On average, sellers will assign a higher dollar value to a good than potential buyers, reducing the set of mutually acceptable trades (Kahneman, Knetsch, Thaler, 1990). The endowment effect is more pervasive in markets for consumption goods, due to the effect of value ambiguity on preferences. Evidence of the endowment effect in markets for exchange goods would not be expected to be observed when intrinsic value is predetermined. However, van Dijk and van Knippenberg (1996) found evidence that the endowment effect may persist in markets for exchange goods when traders are uncertain about future exchange prices.

The existence of the endowment effect also can be examined from a cost analysis perspective. Economic theory states that all costs are in some capacity opportunity costs. Hence opportunity costs should be evaluated in the same manner as out-of-pocket costs. In prospect theory, the benefit sacrificed and the benefit received that result from an exchange are viewed separately, with the sacrifice being coded as a loss and the benefit received being coded as a gain. The shape of the value function implies that if out of pocket costs are viewed as losses (a reduction in wealth position) they will be more heavily weighted than the opportunity cost of foregone gains (i.e. the gain of acquisition of a good). Thaler (1980) uses this underweighing of opportunity costs as an alternative explanation of the endowment effect. This explanation of the endowment effect manifests itself in two different ways. From the seller perspective, the out of pocket cost that is coded as a loss for a good is of greater negative magnitude than the

opportunity cost of not receiving the benefit of the offered monetary value. From the buyer perspective, the out-of-pocket cost (that is coded as a loss when viewed in isolation) of money to purchase the good is of greater negative utility magnitude than the opportunity cost of not receiving the benefit relating to the acquisition of the good. In addition to explaining the mechanics of the endowment effect, this rationale also presents further evidence of status-quo bias in that a utility premium must be offered to entice one to leave their established wealth position or status quo.

Summary

The house money effect and the endowment effect are two phenomena that are testable in an experimental setting. Experimental markets in which value assessments are elicited from subjects with different initial reference positions provide an opportunity to observe whether endowment affects valuations and preferences. The experimental structure allows for observation of the endowment effect or lack thereof. In addition, the house money effect is also examined in the following context. Accumulated wealth is a function of the outcomes associated with risky prospects. Subsequent behavior observed in subjects with new wealth positions allows the relationship between wealth position and behavior to be studied.

Chapter 3: Research Problem and Hypotheses

This paper will examine the existence and significance of the endowment effect and the framing effect of wealth position in evaluating prospects and trades under uncertainty. Experimental evidence of these phenomena can be explained by the descriptive power of prospect theory, particularly as it pertains to the effect of reference position on preferences. Furthermore, the descriptive power of the value function is analyzed. Evidence of the endowment effect is examined in the context of markets for goods of uncertain, randomly determined value, with determinant expected value. The degree to which the effect of cumulative wealth affects valuation behavior is also examined. In addition, the degree to which learning reduces bargaining behavior pricing biases in a market setting will be examined. Finally, the scope of the endowment effect will be qualified by analyzing the effect of broadened seller behavior in the market setting.

Prospect Theory and the Endowment Effect: Hypotheses

The primary focus of this study is to analyze the manifestation of the endowment effect in a market for goods under uncertainty. The endowment effect should prevail in market settings, with buying prices lower than selling prices. The endowment effect is persistent over time. It is not an anomalous behavior that diminishes in intensity due to the effect of learning. Cumulative wealth position influences economic decision making in current periods. Prospect theory predicts that behavior is more risky in the domain of gains which is known as the "house money" effect. Risk tolerance also influences economic decisions under uncertainty. More risk tolerance will relate to higher valuation of a good with uncertain prospects.

The first hypothesis, H1a, relates to the persistent divergence of buyer and seller valuations of a good; it is stated as follows:

H1a: In markets for goods under uncertainty, seller valuations will on average be greater than buyer valuations.

Valuation is price or value assigned to the good where the subject would be indifferent between the good and the price or value in cash. This state will not be due solely to the manifestation of common bargaining behavior practices, since learning over repeated markets leads to more consistent valuations of both buyers and sellers. The research hypothesis H1b leads to a test for loss aversion and status-quo bias (elements of prospect theory behavior) in both buyers and sellers. The preferences exhibited by good valuations are not changed with learning, since they are the result of reference positions, not misunderstanding of the market setting:

H1b: Learning in previous market settings will not correct for divergence observed in buyer and seller valuations.

The effect of cumulative wealth will create a framing effect that will affect the valuation of the good. This will be due in part to the "gambling with the house money" phenomenon. The "house money" phenomenon is a manifestation of the more risk tolerant behavior observed over the domain of gains than losses. High cumulative wealth is achieved by the acquisition of goods of uncertain value that increase in value. Therefore, high cumulative wealth implies prior period gains, which should lead to more risk tolerance, which is measured by higher valuation of the uncertain value good. The following hypotheses (H2a and H2b) allow us to test for the presence of this phenomenon:

H2a: In a market setting, higher levels of cumulative wealth at the beginning of a market will induce higher valuations of the good of uncertain value.

H2b: Wealth position and risk-tolerance are positively correlated in a market setting for goods of uncertain value.

Since the good is of uncertain value, risk propensities will inherently affect valuation, even if the endowment effect is influencing valuation as well. It is characteristic of expected utility theory that more risk tolerant agents do not discount a prospect because of higher return deviations, as the following hypotheses indicate:

H3a: For all market participants, higher valuations will be associated with greater risk tolerance, due to the decreased discounting of uncertainty by risk tolerant agents.

H3b: Manifestation of the endowment effect induces higher valuations of the uncertain value good for sellers than buyers of similar risk tolerance.

These hypotheses will test for the existence of the endowment effect and framing effects in the evaluation of prospects and trades. Risk averse and risk-seeking behavior is an unavoidable externality in the analysis of the endowment effect in markets for goods of uncertain value. Instead of ignoring this experimental condition, the degree to which the endowment effect is present is tested by comparing subjects in both buyer and seller roles with similar risk profiles. This allows for the separation of risk tendency from the endowment effect analysis, and therefore more conclusive data.

Chapter 4: Experimental Design and Methodology

The phenomena of externalities affecting economic decision-making are readily testable in an experimental context. Thaler (1980, 1990), Kahneman and Tversky (1979), Franciosi, Kujal, Michelitsch, Smith, and Deng (1996), van Dijk and van Knippenberg (1996), and Kahneman, Knetsch, and Thaler (1990) each argue that the endowment effect persists in economic decision-making. Arkes and Blumer (1985), Staw (1976), Thaler (1980) each argue that sunk costs (costs borne in prior periods) have a significant effect on current period decision-making. This contrasts with the rational agent hypothesis central to economic theory that states that sunk costs are to be ignored. Laughhunn and Payne (1984) expanded the scope of the study of how prior period outcomes affect current period decisions under uncertainty by investigating how prior period gains, which they label "sunk gains," affect decisions. These studies each provide evidence of the significant impact externalities can have on economic decision making. Of particular interest to this study is the prior evidence of the endowment effect in markets of uncertainty, and the effect of prior period losses and gains on current period decision making.

Experimental markets are used to test for the existence of the endowment effect under uncertainty and the current period effects of prior period outcomes. The use of experimental markets allowed control over the subjects' initial endowment and wealth position relative to the experiment. These factors are difficult to evaluate in naturally occurring markets, as the impact of bargaining behavior and prior period outcomes are difficult to assess.

Experimental markets can provide support for the predictions of the endowment effect and other quasi-rational hypotheses. In addition, experimental markets provide evidence that subjects' behavior is consistent with the assumptions of prospect theory under uncertainty.

Specifically, actual human behavior is not accurately characterized by the rational, optimizing behavior that is central to neoclassical economics.

Experimental Market

Forty-five students participated in the experiment. Twenty-six students comprised group one and nineteen students comprised group two. Within each group, paid subjects were randomly assigned positions (buyer or seller) which would remain constant over the three market periods of the experiment. Subjects were volunteers taking an intermediate cost accounting course at The Ohio State University. They were advised of the time commitment of approximately 80 minutes, and informed that the expected payment was $3.75, with higher and lower payments possible depending on their performance and whether or not they held winning lottery tickets over the course of the experiment. The experiment took place during regularly scheduled class time.

The market setting allowed for the collection of value assessments of an uncertain value lottery ticket with expected value of $.50 from subjects in the role of either buyer or seller. "Valuation" was explained to subjects to mean the indifference value between the lottery ticket and that monetary pay-out. Once valuations were collected, a market price was determined by taking the median value assigned to the lottery tickets by the subjects, irrespective of their buyer or seller designation. In this way, the scope of seller behavior was expanded to make sellers also potential buyers, should their valuations be higher than the median group valuation. This design was introduced into the experimentation to minimize the valuation discrepancy due to standard bargaining behavior. The overall experimental design also sought to eliminate the effect of bargaining behavior by stressing the one-valuation-per-market structure of the experiment and that there would be no haggling or over-the-counter trades. This introduced a dynamic ticket

variable design into the experiment. This incomplete market structure meant that the number of outstanding tickets at the end of each market varied and that the "market price" was not a market-clearing price in the true economic sense.

Experimental Task

The subjects had economic incentives consistent with a person evaluating the prospects of a fair lottery ticket under uncertainty. The two possible outcomes and the method of outcome determination were explained within information packets distributed to subjects. Subjects were also given the opportunity to ask questions about the instructions and/or any aspect of the experimental procedure.

There were two types of information packets, one for buyers and one for sellers. Each buyer information packet stated that the subject had a $1.25 credit and the opportunity to purchase a lottery ticket. Seller information packets stated that the subject had $.75 credit and a lottery ticket. The lottery ticket would pay out either $1.00 or $0 depending on the outcome of a random card drawing (a heart of diamond drawn at random indicated a particular ticket was a winner, a club or spade drawn indicated that a particular ticket was a loser). Subjects were told that there would be three markets, each with a separate lottery. Each lottery ticket would be valid only for the market during which it was distributed. Subjects were asked to write down how much the described lottery ticket was worth to them (this assessment is referred to as the subject's "valuation" of the lottery ticket). While subjects assessed the value of the lottery tickets they were instructed that once they had finished, the information packets would be collected and evaluated to determining the market price. The exact mechanism for determining the market price was not described to the subjects. After the collected valuations were assessed, the market price was announced to the subjects. After exchanges were made and the lottery was

conducted, subjects were asked to calculate their ending wealth position and repeat the lottery ticket valuation. For the second market, subjects were advised that in addition to any market one wealth accumulated that they also had an additional $.75 and a new lottery ticket (for sellers) or an additional $1.25 (for buyers). The subjects were advised of the same conditions for the beginning of the third market.

Post Experimental Procedures, Endowment, and Rewards

At the conclusion of the market three exchanges and lottery, subjects were directed to complete a risk profile questionnaire. The risk profile assessment consisted of the evaluation of nine two option scenarios. Each scenario offered the option for a certain lump sum of money or the chance at either of two sums of money with known probabilities attached. Three of the scenarios offered fair, risk neutral options. Three scenarios offered options with the lump sum having a greater expected value than the option with the chance at either of two sums with known probabilities attached. Finally, three scenarios offered options with the option with the chance at either of two sums with known probabilities attached having greater expected value than the option with a certain lump sum pay-out.

As each subject completed the risk assessment, they were paid in cash their cumulative earnings and/or winnings for the three market periods. No compensation was based on answers provided on the risk assessment. Prior to the beginning of the experiment, all subjects were informed that they would keep any money given to them, acquired through the sale of lottery tickets, and won in the lottery. For each market, both buyers and sellers were each given assets with an expected value of $1.25. Buyers were given $1.25 in the form of a credit, sellers were given one lottery ticket (which only could be used in the market it was designated for) with an expected value of $.50 and $.75 credit.

Chapter 5: Analysis of Results

For group one, average compensation was $3.65 for buyers and $3.62 for sellers. Group two results showed buyers with average compensation of $3.61 and sellers $3.85. The divergence in group two buyer and seller compensation could have been the result of exuberant lottery ticket valuation on the part of sellers. This in turn led sellers to retain their lottery ticket and in many cases acquire a second lottery ticket over the course of the three markets. With sellers having multiple opportunities to realize the potential $1.00 prize from winning lottery tickets, they were able to earn compensation $.24 greater than their buyer counterparts in group two.

The analysis of this experiment is concerned with studying evidence of two primary phenomena. The first phenomenon is higher valuations assigned to the lottery tickets by sellers who are already in possession of a lottery ticket than buyers who are given a monetary entitlement (hypotheses H1a and H1b). To this end, valuation data is collected for each subject for each of the three markets, and average valuation for each subject is calculated (see table 5.1).

Table 5.1: Average Valuations by Group and Classification

Group One				
	Mkt 1	**Mkt 2**	**Mkt 3**	**Mean Valuation**
Mean seller valuation	$ 0.60	$ 0.64	$ 0.72	$ 0.65
Mean buyer valuation	$ 0.54	$ 0.67	$ 0.61	$ 0.61
Group Two				
	Mkt 1	**Mkt 2**	**Mkt 3**	**Mean Valuation**
Mean seller valuation	$ 0.63	$ 0.55	$ 0.54	$ 0.57
Mean buyer valuation	$ 0.53	$ 0.42	$ 0.45	$ 0.47

The second phenomenon is the higher valuations assigned to the lottery tickets by subjects (both buyers and sellers) with a high cumulative wealth level. Ending wealth at the end of each market is calculated by the subject and verified by the instructor for each subject (see table 5.2).

Table 5.2 Correlation between Wealth Level and Valuation

Group One			
	Mkt 2	**Mkt 3**	**Mean correlation**
Seller wealth/valuation correlation	-0.2382705	0.1061831	-0.06604366
Buyer wealth/valuation correlation	0.0820575	-0.2934983	-0.105720413
Group Two			
	Mkt 2	**Mkt 3**	**Mean correlation**
Seller wealth/valuation correlation	0.551411	0.1837478	0.367579366
Buyer wealth/valuation correlation	0.2563496	-0.1861458	0.035101871

In addition to these two issues, the relationship of risk tolerance level and lottery ticket valuation is also examined. This will determine the degree to which risk tolerance, as measured by the risk assessment test, translates into higher lottery ticket valuations by subjects.

Evidence of the Endowment Effect

Hypothesis H1a states that over each of the three markets and the aggregate of markets one through three there would be divergence in values assigned to the lottery tickets by subjects given a lottery ticket than by subjects not given a lottery ticket. The data for group one is shown below (see table 5.3):

Table 5.3 Group 1 Subject Valuations

Sellers	**Mkt 1**	**Mkt 2**	**Mkt 3**	**Average**
1	0.6	0.51	0.51	0.54
2	0.38	0.6	0.6	0.526667
3	0.75	0.75	0.85	0.783333
4	0.75	0.75	1	0.833333
5	0.01	0.25	0.5	0.253333
6	0.5	0.51	0.65	0.553333
7	0.5	0.5	0.75	0.583333
8	1	0.75	0.5	0.75
9	1	1	1	1
10	0.5	0.75	0.25	0.5
11	0.25	0.5	1	0.583333
12	1	0.75	0.76	0.836667
13	0.5	0.75	1	0.75
Mean	0.595385	0.643846	0.720769	0.653333
Std. Dev.	0.300517	0.189012	0.243942	0.194503
Buyers	**Mkt 1**	**Mkt 2**	**Mkt 3**	**Average**
14	0.42	0.75	0.25	0.473333
15	0.5	0.25	0.3	0.35
16	0.5	0.75	0.5	0.583333
17	0.4	0.5	0.5	0.466667
18	0.95	0.8	0.6	0.783333
19	0.5	0.75	1	0.75
20	0.5	1	0.75	0.75
21	0.4	0.5	0.75	0.55
22	0.35	0.55	0.4	0.433333
23	0.75	0.6	0.5	0.616667
24	0.45	0.75	1	0.733333
25	0.5	0.75	0.65	0.633333
26	0.75	0.75	0.75	0.75
Mean	0.536154	0.669231	0.611538	0.605641
Std. Dev.	0.173663	0.186568	0.236426	0.143394

For markets one and three, average seller valuations exceeded average buyer valuations by .06 and .11 respectively. Market two data observed an average buyer valuation .03 greater than the average seller valuation. The divergent result of market two may be attributable to a number of factors, such as a slightly higher risk level affecting buyer valuations, as buyers sought to recoup market one losses. The market two anomalies could also be due to sellers wishing to lock in their accumulated wealth and not risk losing on a lottery ticket priced in excess of its expected value. Despite the market two anomaly, overall for group one seller valuations averaged $.05 more than buyer valuations. The group one data provides supporting evidence of the endowment effect.

For group two, seller valuations exceeded buyer valuations for each of the three markets by .10, .13, and .09 respectively. Overall for group two, average seller valuations exceeded buyer valuations by .10. For each market, sellers on average valued the tickets more highly than buyers. This evidence also supports the existence of the endowment effect (see table 5.4).

Table 5.4: Group 2 Subject Valuations

Sellers	Mkt 1	Mkt 2	Mkt 3	Average
1	1	1.25	1.5	1.25
2	0.5	0.25	0.36	0.37
3	0.45	0.45	0.5	0.466667
4	0.8	0.2	0.1	0.366667
5	1	1	0.75	0.916667
6	0.5	0.75	0.75	0.666667
7	1	1	0.5	0.833333
8	0.5	0	0.35	0.283333
9	0	0.1	0.35	0.15
10	0.5	0.5	0.2	0.4
Mean	0.625	0.55	0.536	0.570333
Std. Dev.	0.322533	0.430116	0.39814	0.34006
Buyers	**Mkt 1**	**Mkt 2**	**Mkt 3**	**Average**
11	0.5	0.5	0	0.333333
12	0.5	0.5	0	0.333333
13	0.25	1	0.5	0.583333
14	0.25	0.4	0.45	0.366667
15	1	0.25	0	0.416667
16	0.5	0.25	0.5	0.416667
17	0.25	0.62	0.63	0.5
18	0.5	0.25	0.75	0.5
19	1	0	1.25	0.75
Mean	0.527778	0.418889	0.453333	0.466667
Std. Dev.	0.291667	0.285633	0.414548	0.135401

Each of the test groups on average demonstrated higher seller than buying prices. Critics of quasi-rational economic phenomena state that higher buyer than seller valuations is common to standard bargaining behavior, and can be corrected due to learning in multi-period markets. Standard bargaining behavior is the observation that initial buyer willingness to accept prices being overstated and initial seller willingness to pay prices being understated. It is observed that market three continued to exhibit this outcome of higher seller valuations. Therefore learning over the course of a three-market setting is unable to eradicate the buyer seller valuation differential. The aggregate of this evidence supports the notion of the endowment effect being to some degree responsible for the divergent buyer seller valuations.

These observations suggest that the endowment effect influences seller valuations in markets of uncertainty. Hypothesis H1b states that learning over markets one and two will not correct the divergent buyer and seller valuations, as market three seller prices will remain higher than market three buyer prices. To minimize the buyer seller value deviations due to bargaining behavior, subjects were informed that this was a one valuation no haggling market. In addition, the three period market also would allow for learning to take place. The effect of learning in a market setting is that buyer and seller valuations converge, as subjects realize exchanges will not take place at over or understated valuations. The failure of buyer and seller valuations to converge over multiple markets is indicative of other factors at work, including the endowment effect. Observed market three seller valuations exceeded market three buyer prices for both group one and two by .10 and .04, respectively. In neither group was this the smallest magnitude buyer/seller valuation divergence. The observation of persistent divergences in buyer and seller valuations indicates that learning over market one and two does not eliminate the divergence. Another possible factor causing the buyer seller valuation divergence is that buyers are less risk tolerant than sellers. If buyers are less willing to take the risk of the lottery ticket, they will value it less, instead opting to retain a certain amount of money. The influence of risk propensity on buyer and seller behavior is taken up more thoroughly in the analysis of evidence of hypotheses H3a and H3b. In summary, the data presented in the above analysis supports evidence that an endowment effect indeed manifests itself in the seller valuation decision.

Cumulative Wealth Effects: "Gambling with the House Money"

The effect of initial reference positions on preferences is examined in the context of markets of uncertainty by observing how the framing effect of cumulative wealth level affects subjects' valuation of a lottery ticket. One phenomenon derived from the postulates of prospect yheory is that economic agents set up unique mental accounts for different economic decision environments. That is, it is wealth relative to a particular environment that influences current period decision-making, not the absolute level of wealth. The manner in which evidence of the "gambling with the house money" effect is tested is explicated formally in hypothesis H2a. Evidence of a greater cumulative wealth level resulting in higher lottery ticket valuations is due to more risk tolerant behavior being exhibited in a given environment if a subject has accumulated wealth in that environment. The "gambling with the house money effect", or "wealth effect," is tested by examining the relationship between changes in wealth position and valuation behavior among individual subjects. The correlation between beginning of period two wealth and period two valuation, and beginning of period three wealth and period three valuation is also examined to observe any general relationship between wealth and valuations across subject groups. Since all buyers receive identical beginning of period one entitlements and all sellers receive identical beginning of period one entitlements, there is no possibility to observe the "wealth effect" of gambling with the house money in period one.

An examination of individual subject wealth effect shows that seven of the twenty-four subjects in group one exhibited more risk tolerant valuation for markets two and three corresponding to higher beginning of period two and three wealth levels, respectively. As shown in table X, five subjects in group one exhibited a positive relationship between these two variables for market three. The failure of these five subjects to demonstrate the wealth effect

may be due to slower learning of the market structure. Of the remaining group one subjects, one exhibited a negative wealth effect in both markets two and three valuations. The thirteen remaining subjects demonstrated erratic valuation behavior relative to changing wealth level. Again, this may be due to slower learning of the market structure for these subjects. This analysis of individual behavior provides evidence that amongst individual subject data there is indication of a weak relationship between wealth position and valuation (see table 5.5).

Table 5.5: Group 1 Subject Wealth and Valuation Patterns

Sellers	Beg. Mkt 1 Wealth	Mkt 1 Valuation	Beg. Mkt 2 Wealth	Mkt 2 Valuation	Beg. Mkt 3 Wealth	Mkt 3 Valuation
1	0.75	0.6	3	0.51	4.5	0.51
2	0.75	0.38	2	0.6	3.5	0.6
3	0.75	0.75	1	0.75	3	0.85
4	0.75	0.75	3	0.75	5	1
5	0.75	0.01	2	0.25	3.5	0.5
6	0.75	0.5	2	0.51	3.5	0.65
7	0.75	0.5	2	0.5	3.5	0.75
8	0.75	1	1	0.75	1	0.5
9	0.75	1	2	1	4	1
10	0.75	0.5	2	0.75	4	0.25
11	0.75	0.25	2	0.5	3.5	1
12	0.75	1	1	0.75	1	0.76
13	0.75	0.5	2	0.75	3	1
Mean	0.75	0.595384615	1.923076923	0.643846154	3.307692308	0.720769231
Std. Dev.	0	0.300516649	0.640512615	0.189012277	1.164375039	0.243941986
Buyers	**Beg. Mkt 1 Wealth**	**Mkt 1**	**Beg. Mkt 2 Wealth**	**Mkt 2**	**Beg. Mkt 3 Wealth**	**Mkt 3**
14	1.25	0.42	2.5	0.75	4	0.25
15	1.25	0.5	2	0.25	3.25	0.3
16	1.25	0.5	2	0.75	3.5	0.5
17	1.25	0.4	2.5	0.5	3.75	0.5
18	1.25	0.95	3	0.8	3.5	0.6
19	1.25	0.5	3	0.75	3.5	1
20	1.25	0.5	2	1	2.5	0.75
21	1.25	0.4	2.5	0.5	3.75	0.75
22	1.25	0.35	2.5	0.55	3.75	0.4
23	1.25	0.75	3	0.6	4.25	0.5
24	1.25	0.45	2.5	0.75	3	1
25	1.25	0.5	2	0.75	3.25	0.65
26	1.25	0.75	3	0.75	4.5	0.75
Mean	1.25	0.536153846	2.5	0.669230769	3.576923077	0.611538462
Std. Dev.	0	0.173663394	0.40824829	0.186568197	0.524251603	0.236426386

At the group level, results indicate that sellers did not exhibit evidence of cumulative wealth level and lottery ticket valuation to be strongly related. Market two cumulative wealth and valuation correlation for buyers is actually -.24. This indicates that the actual relationship between cumulative wealth and valuation is inversely related for this observation. A negative correlation may indicate a "regret" or "correction" effect in which subjects change the manner in which they value the lottery ticket. Market three results show an extremely weak positive correlation of .19. Neither of these measures is indicative of a strong relationship between cumulative wealth and valuation behavior. Group one results for buyers indicate similarly inconsistent relationships between cumulative wealth and valuations. Market two cumulative wealth and valuation correlation for sellers is very weakly related with a positive correlation of .08. The market three relationship exhibits a negative relationship between cumulative wealth and valuation of -.29. A negative correlation indicates that lottery ticket valuation actually decreased as cumulative wealth increased.

Similarly to group one, group two subjects are analyzed for evidence of a wealth phenomenon affecting valuations behavior on an individual level. Three of nineteen subjects exhibited increased or decreased valuations with increases or decreases in wealth position, respectively. An additional six of the nineteen demonstrated this relationship in their market three valuations. Again, the failure of these six subjects to exhibit this wealth effect may be due to failure to learn the market structure quickly. Two of the nineteen subjects in group two exhibited a negative relationship between wealth level and valuation level for markets two and three. The remaining six of the nineteen subjects in group two exhibited erratic valuation levels relative to wealth position. This study of individual subjects demonstrating a wealth level-valuation relationship is consistent with the findings of the group one subjects. Weak evidence

supports the existence of wealth level affecting valuation level in individual subjects (see table 5.6).

Table 5.6: Group 2 Subject Wealth and Valuation Patterns

Sellers	Beg. Mkt 1 Wealth	Mkt 1	Beg. Mkt 2 Wealth	Mkt 2	Beg. Mkt 3 Wealth	Mkt 3
1	0.75	1.00	2.00	1.25	2.55	1.50
2	0.75	0.50	2.00	0.25	3.20	0.36
3	0.75	0.45	2.00	0.45	3.20	0.50
4	0.75	0.80	1.00	0.20	2.20	0.10
5	0.75	1.00	2.00	1.00	3.30	0.75
6	0.75	0.50	2.00	0.75	4.30	0.75
7	0.75	1.00	2.00	1.00	4.30	0.50
8	0.75	0.50	1.00	0.00	2.20	0.35
9	0.75	0.00	2.00	0.10	3.20	0.35
10	0.75	0.50	2.00	0.50	2.30	0.20
Mean	0.75	0.62500	1.80000	0.55000	3.07500	0.53600
Std. Dev.	0	0.32253	0.42164	0.43012	0.78218	0.39814
Buyers	**Beg. Mkt 1 Wealth**	**Mkt 1**	**Beg. Mkt 2 Wealth**	**Mkt 2**	**Beg. Mkt 3 Wealth**	**Mkt 3**
11	1.25	0.5	2	0.5	2.8	0
12	1.25	0.5	2	0.5	3.8	0
13	1.25	0.25	2.5	1	3.3	0.5
14	1.25	0.25	2.5	0.4	3.75	0.45
15	1.25	1	3	0.25	4.25	0
16	1.25	0.5	2	0.25	3.25	0.5
17	1.25	0.25	2.5	0.62	4.3	0.63
18	1.25	0.5	2	0.25	3.25	0.75
19	1.25	1	2	0	3.25	1.25
Mean	1.25	0.52778	2.27778	0.41889	3.55000	0.45333
Std. Dev.	0	0.29167	0.36324	0.28563	0.50621	0.41455

Group two data for the wealth-valuation relationship yields inconsistent results similar to group one. Group two sellers in market two had the strongest positive correlation between cumulative wealth and lottery ticket valuation of .55. However in market three, group two sellers exhibited only a .18 positive correlation between these two variables. Group two sellers were the only subgroup to have a positive correlation between cumulative wealth and lottery ticket valuation for both markets two and three.

Group two buyers results are inconclusive. For market two, wealth and valuation were positively correlated at .26. Market three correlation is negative at -.19. The results for this subgroup are representative of the inconsistent observations relating to this hypothesis.

Many factors can account for the inconsistent findings regarding wealth effects. The results from data relevant to this hypothesis indicate that there is no consistent bias induced by prior period gains represented by the cumulative wealth generated by subjects in prior period markets. Empirical evidence from prior experiments suggest that prior period gains influence current period decision making in a systematic and predictable manner; weak evidence supporting hypothesis H2a is observed in this experiment.

Evidence of a "wealth effect" is also examined in the context of relating cumulative wealth position at the conclusion of the market three lottery to results from a risk assessment instrument administered after the final wealth position became known to the subject. This analysis tests the relationship between wealth level in a particular mental account and current risk propensity. The risk assessment instrument is scored in the following manner. For three of the bimodal options, the gamble's expected value exceeds the value of the lump sum alternative; subjects received .5 points each for taking the gamble for each of these three options. A second group of three bimodal options offered the choice between a gamble with expected value equal to the value of the lump sum alternative; for each accepted risk neutral gamble 1.0 point is received. The final set of three bimodal options offered the choice between a gamble with expected value less than the value of the lump sum alternative; for each accepted risk loving gamble 1.5 points are received. The sum of points earned for the nine bimodal options is assigned to the subject as the risk assessment score, in an effort to segment subjects according to risk propensity, and draw conclusions about relative risk tolerance and valuation behavior. A

score of 0 to 1.5 classified a subject as low risk tolerant, 2.0 to 4.5 as medium risk tolerant, and 5.0 to 9.5 as high risk tolerant.

Hypothesis H2b states that final wealth position and risk level score will be positively correlated. This hypothesis is drawn to test for the existence of a wealth effect leading agents to a generally higher level of risk tolerance. This is due to prior period gains being integrated with potential losses incurred through accepting gambles that would otherwise not be considered had a prior period gain not been incorporated into the evaluation of the incremental outcomes of the gamble.

For group one sellers, there is a weak negative correlation of .16 between ending wealth and risk level. This evidence is contrary to what is expected if higher levels of wealth lead to more risk tolerant decision-making. For group one buyers, there is also a weak negative correlation (-.08) between ending wealth and risk level. Both of these results offer no support of a positive relationship between wealth effect and risk tolerance, at least insofar as it is accurately measured by the risk assessment instrument (see table 5.7).

Table 5.7: Group 1 Ending Wealth and Risk Level by Subject

Sellers	Ending Wealth	Risk Level		Buyers	Ending Wealth	Risk level
1	5.15	3.5		14	4	2.5
2	4.15	2		15	3.25	2.5
3	2.35	0.5		16	3.5	4
4	5.35	1.5		17	3.75	1.5
5	4.15	2.5		18	3.5	4.5
6	3.85	1.5		19	2.85	0.5
7	4.85	1.5		20	2.85	4.5
8	1.65	3.5		21	3.85	2.5
9	4.35	0.5		22	3.75	2
10	4.65	5		23	4.25	4.5
11	3.85	2		24	3.85	2.5
12	0.35	3.5		25	3.25	2.5
13	2.35	2.5		26	4.85	1.5
Mean	3.619230769	2.307692308		Mean	3.653846154	2.730769
Std. Dev.	1.164375039	1.299654787		Std. Dev.	0.552819115	1.284773
Correlation		-0.155303586		Correlation		-0.08055

Group two sellers ending wealth levels and risk levels are slightly positively correlated at .29. This is the only subgroup yielding a positive wealth-risk level relationship, and yet, it is a fairly weak positive relationship. This observation, when viewed in conjunction with results from the other three subgroups, does not provide supporting evidence of a wealth effect influencing risk propensity as measured in the experiment. Group two buyers ending wealth levels and risk levels again reflect a negative correlation (-.72). This fairly strong negative correlation may actually supports a reverse wealth effect. In this case, increased wealth would actually lead to more risk averse decision-making. This may be due to subjects' stronger desire to preserve prior period gains than their desire to take on a prospect with an uncertain outcome (see table 5.8).

Table 5.8: Group 2 Ending Wealth and Risk Level by Subject

Sellers	Ending Wealth	Risk level		Buyers	Ending Wealth	Risk level
1	3.8	4.5		11	2.8	5
2	3.7	7.5		12	3.8	0.5
3	4.7	7.5		13	2.8	3.5
4	2.7	4.5		14	3.75	1.5
5	4.8	8.5		15	4.25	0.5
6	3.8	3		16	3.75	2
7	5.8	1.5		17	4.8	0
8	2.7	1		18	3.75	2
9	3.7	0		19	2.75	1
10	2.8	1.5				
Mean	3.85	3.95		Mean	3.605555556	1.777778
Std. Dev.	1.012422837	3.050045537		Std. Dev.	0.704647272	1.602949
Correlation		0.28695905		Correlation		-0.71811

There are many explanations why the wealth effect does not more strongly manifest itself in the context of the experimental observations. One reason may be that the risk assessment, which elicits hypothetical decision-making, may not accurately reflect true risk propensity. There exists no financial compensation for completing the risk assessment, so there is no

financial incentive for a subject to accurately complete the instrument. A second possible problem is that the actual relationship between wealth level in a particular mental account does not strongly influence risk propensity. If this is the case, even if the risk assessment instrument is representative of a subject's risk propensity, there would not be a strong correlation between wealth and risk propensity. The evidence observed in this experiment only weakly supports the existence of a strong wealth effect, insofar as how this phenomena is tested for in this experiment through an analysis of the wealth-valuation relationship for individuals and groups. There is evidence that more wealth in the mental account for the experimental setting relates to higher valuations by the individual relative to their prior period wealth and valuation level. Observations of individual behavior for both groups demonstrate weak support for hypothesis H2a. Given the high degree of variability in the valuations given by subjects, the tests for the wealth effect in individuals provides more meaningful data in assessing the wealth effect. The reason for this is that the wealth effect is specifically concerned with how changes in wealth reference position affect risk propensity (measured implicitly in lottery ticket valuation) in an individual's behavior, not group behavior. While an analysis of the correlation between wealth and valuations is helpful in observing trends in wealth and valuation behavior, it is a less accurate measure of the persistence of the wealth effect.

The Effect of Risk Propensity: Evidence of the Endowment Effect

In the experiment, a risk measurement instrument is used in an attempt to evaluate risk tolerance levels. The instrument was structured as to delineate subjects into three groups, risk averse, risk neutral, and risk tolerant (higher scaled scores being indicative of higher risk tolerance levels as measured by the instrument).

For group one. subjects classified as risk averse averaged valuations steadily increased across the three markets, irrespective of buyer or seller roles. Medium risk classified subjects were relatively low in market one at $.53, but increased to to the $.62-.64 level for markets two and three. The sole high-risk subject in group one exhibited erratic valuation patterns, ranging from $.25 in market three to $.75 in market one. Overall, there is no pattern for group one relating risk propensity as measured by the instrument to valuation level. There is no pattern among data for any of the individual markets. Aggregate market data for group one indicates that as risk increased, valuations declined (see table 5.9)

Table 5.9: Group 1 Valuations within Risk Level Classifications

Number of Subjects				
low risk	**mkt 1**	**mkt 2**	**mkt 3**	**avg.**
5	0.7	0.7	0.85	0.75
3	0.55	0.67	0.75	0.656667
	0.64375	0.68875	0.8125	0.715
med risk				
7	0.53	0.59	0.7	0.606667
10	0.53	0.67	0.57	0.59
	0.53	0.637059	0.623529	0.596863
high risk				
1	0.5	0.75	0.25	0.5

Group two indicated similar results. Low risk subjects average valuations ranged from $.30 to $.64. Medium risk subjects average valuations ranged from $.38 to $.46. High risk subjects valuations ranged from $.41 to $.61. For each individual market, market two illustrates greater risk levels being associated with higher valuations. Overall averages across the three markets illustrates weak support for the direct risk tolerance-valuation relationship. However, the risk tolerant subjects for group two is higher than the risk averse subject group. It is

important to note that the risk neutral group average valuation is the highest average valuation for group two (see table 5.10).

Table 5.10: Group 2 Valuations within Risk Level

Number of Subjects				
low risk	**mkt 1**	**mkt 2**	**mkt 3**	**avg**
4	0.5	0.4	0.35	0.416667
5	0.75	0.22	0.57	0.513333
	0.63889	0.3	0.472222	0.47037
medium risk				
3	0.5	0.25	0.36	0.37
3	0.42	0.5	0.58	0.5
	0.46	0.375	0.47	0.435
high risk				
3	0.65	0.57	0.54	0.586667
1	0.5	0.5	0	0.333333
	0.6125	0.5525	0.405	0.523333

These results indicate little evidence of the relationship of risk level as measured by the experimental instrument and valuation behavior. Therefore, support is not found for hypothesis H3a, which states that for all market participants, higher valuations will be associated with greater risk tolerance, due to the decreased discounting of uncertainty by risk tolerant agents.

An examination of risk level and valuation behavior across the buyer and seller subject classifications indicates that evidence of the endowment effect can be examined without risk variation amongst subjects corrupting the results.

For group one, low risk sellers valued the ticket more highly than low risk buyers for markets one, two, and three. Risk neutral subjects exhibited seller valuations higher than buyer valuations for markets one and three, and the average of the three markets. For risk tolerant subjects, there is only data for one risk tolerant seller, and there were no risk tolerant buyers—therefore data for risk tolerant subjects is not available in group one. Overall, evidence

supporting the endowment effect among risk classified subjects is supported by data collected from group one.

For group two, comparisons of low risk seller and low risk buyer valuations do not exhibit any discernable pattern supporting the endowment effect across risk classifications. Risk neutral sellers did exhibit dominant valuation behavior to risk neutral sellers, indicating supporting evidence of hypothesis H3b. Risk tolerant subjects also exhibited dominant seller valuations over buyer valuations for each of the three markets. It is important to note however, that there is only data for one risk tolerant seller in group two; and this subject exhibited erratic valuation behavior of $.50, $.50, and $0 for markets one through three respectively.

Overall, there does exist some degree of support for hypothesis H3b that manifestation of the endowment effect induces higher valuations of the uncertain value good for sellers than buyers of similar risk tolerance. This data for groups one and two indicate that this phenomenon manifests itself with few exceptions that are described above.

In summation, it is important to systematically analyze the impact of relative risk levels amongst subjects when testing for the endowment effect since this preference unavoidably influences valuation behavior in a market of goods with uncertain probability attached values. Since more risk tolerant subjects will discount the deviations in cash flows less (and in some cases assess a premium) than their risk averse counterparts, it is inevitable that risk tolerant subjects should exhibit higher valuations on average than similarly endowed risk tolerant subjects. The data for groups one and two support this hypothesis, however exceptions in the data do exist.

Chapter 6: Conclusions and Limitations

In markets of uncertainty, framing effects can be a causal factor in economic decision-making. These framing effects include, but are not limited to, reference position relative to entitlements and wealth level relative to gains and losses experienced in a particular market setting. Differences in risk tolerance are also an important determinant in the economic decision-making process. However, if it is assumed that risk tolerance preferences are distributed similarly across buyer and seller roles in a market, this factor should not affect the determination of the impact of framing effects on economic decision-making. In the context of this thesis, experimental markets are conducted to explore the predictive value of the value function of prospect theory, a descriptive theory of economic behavior that explains framing effects.

Implications

The prospect theory model implies the existence of an endowment effect manifested in higher seller prices than buyer prices. Prospect theory also describes and explains the "gambling with the house money" phenomenon. In the domain of gains in the prospect theory value function, more risk tolerant behavior is described in evaluating prospects with loss prospects less than the magnitude of the prior gain (cumulative wealth in the market setting). Furthermore, relative risk propensity is a factor in decision behavior in markets of uncertainty. This has obvious implications for assessing framing effects in market settings. Divergent risk propensity affects the manifestation of framing effects by increasing valuation level for all market participants.

The existence of the endowment effect has the following policy implications. If economic valuation (indifference buy-sell value) is dependant upon reference position and

ownership entitlement, there are additional considerations in assessing issues of eminent domain cases and other compensatory issues in forced transactions and exchanges. The existence of the endowment effect also changes the expectations for number of transactions expected in a market setting that includes privately owned goods (i.e. secondary markets such as used automobiles). Other secondary markets, such as financial markets, can also be subject to the endowment effect. The manifestation of the endowment effect may arise due to information asymmetry in markets. If sellers have positive information, their perception of value will inherently be greater than buyers lacking such positive information. Furthermore, owners of financial assets may be susceptible to the endowment effect if a certain asset has performed well for them in the past. This valuation of a "sunk gain" is also representative of framing effects affecting valuation. An additional implication of the endowment and other framing effect is that regarding firm manager behavior. A manager that has heavily invested in a failing project may be inclined to continue funding the project, even though other more profitable opportunities are available. Again, the framing effect of sunk costs can account for this non-optimizing economic behavior.

It is important to note that all unique goods are of uncertain value in the sense that it is difficult to assess the marginal utility associated with a good without actual transfer of ownership and consumption. This leads to prospective buyers discounting the value of the good due to uncertainty in the resultant marginal utility. While this indicates another explanation justifying the lower buying than seller prices, there is minimal evidence of the endowment effect existing for exchange goods with known redemption value.

The existence of a wealth effect due to the gambling with the house money observation also has certain implications. One of the most important implications is the existence of total wealth level being segregated into various "mental accounts," each relating to a certain market

setting or situation (i.e. a casino mental account and a stock market mental account). The existence of different mental accounts further validates the usefulness of prospect theory, in that relative reference position and not total wealth is of importance in determining how changes in utility are valued.

Experimental Limitations

The experimental design employed is limited by a number of constraining factors. These constraining factors include the relevance of the incentive structure and subject motivation, learning potential in the market setting, problems with the incomplete nature of the experimental market setting, and the viability of the risk assessment instrument in eliciting a representative measure of subject risk propensity. In addition, possible ways in which to address these limitations are discussed.

Due to unavoidable financial constraints a relatively low financial incentive was involved in the experiment. The experimental markets were conducted during class time, meaning that subjects were a relatively captive audience. While financial compensation for subjects is intended to induce subject motivation, the magnitude of the monetary incentive may have been inadequate in eliciting actual preferences of the subjects. If the monetary incentives were inadequate to motivate the subjects and led to subjects not taking the experiment seriously, the results may not represent actual preferences. More significant monetary incentives could address this potential problem. Subject motivation may also be adversely affected by informal communication in the experiment setting. This could be addressed through the use of a private market setting or a computer market setting where subjects are isolated from one another.

A second limitation area is seen in the limited opportunity for learning written into the experimental design. The number of markets was limited to three, due primarily to time

constraints. To assess whether subjects understand instructions a short test of understanding could be administered prior to the actual markets. In addition, a computer-assisted experiment with a help feature could further explain points of possible confusion. While the opportunity to ask questions was present in the experimental design, subjects may have been reluctant due to the public setting of the experimental design.

The market setting employed was that of an incomplete market that lacked a fixed supply of the good. This structure was utilized to simplify transaction time in each of the markets. However, the mechanism utilized to determine the exchange price of tickets led to a high level of supply and correspondingly low exchange price. Utilization of complete markets and market clearing mechanism would allow for the testing of undertrading in markets due to the endowment effect.

An additional limitation of the experimental design is seen in the utilization of the risk assessment instrument as an accurate measure of subject risk propensity. No compensatory or incentive structure was connected to the subjects' completion of the risk assessment instrument. Without monetary incentive, no explicit subject motivation exists. Difficulty in the determination of actual risk preferences of subjects limits the extent to which the impact risk level has on the manifestation of framing effects in a market setting.

Future Research

Experience with the present study strongly suggests several areas for potential future research. In addition to the experimental modifications proposed to address the limitations discussed in the prior section, testing the validity of the descriptive and predictive value of the prospect theory model has thus far relied upon data gathered in experimental market settings and qualitative observations of actual market settings. However, evidence supporting the descriptive

and predictive value of the value function has never been provided in the form of empirical data. The reason empirical data has not been utilized in prospect theory research is that it is difficult to gather the relevant information, or even determine what market would provide the most relevant data. Although it is difficult to gather the relevant empirical data, an empirical test of prospect theory is an important area of future research. It must be noted that a further complication exists in that prospect theory is a descriptive theory of individual behavior. Unfortunately, available empirical data aggregates individual behavior into market data. Expanding the scope of prospect theory into a descriptive theory of aggregate market behavior could allow for the empirical testing of the validity of prospect theory behavioral descriptions.

In addition to the study of empirical data, another area of research includes the further development of prospect theory as a descriptive model of economic decision-making. The framing effects of the endowment effect and wealth effect are two phenomena that are readily explained by prospect theory. However, there are many other anomalies observed in economic decision making that may also be explained by the prospect theory model.

This thesis represents an attempt to test for evidence of framing effects impacting the economic decision-making process. Furthermore, the manner in which framing effects can significantly affect the economic decision-making process can be seen through a qualitative assessment of empirical evidence. The prospect theory model can account for and describe why and how framing effects systematically influence economic decision-making. This is an important development in light of the fact that expected utility theory and the rational agent hypothesis are the primary descriptive models of economic decision making.

Appendix A

Instructions to Sellers

Instructions for Buyers

You have a $1.25 credit and the opportunity to buy a lottery ticket. This will occur three times, in short periods we will call 'markets.' At the beginning of each market, you will be asked how much a lottery ticket is worth to you. These tickets will pay out either $1.00 or $0.00, determined at the close of each period by a random card drawing. Whether any one ticket is a winner is independent of what happens with the other tickets.

In the second line on the table below, please write down how much a lottery ticket is worth to you. Don't fill in anything else yet! Raise your hand after you have done this. The purchase price of a ticket, which will be called the 'market price,' will be determined by assessing the values assigned to the tickets by all participants. The coordinator will tell you what the market price is after the values assigned to the tickets by all participants are collected. If the amount you are willing to pay for the ticket is higher than the market price, you will buy a ticket at the market price. Otherwise, you will not buy a ticket, and receive your money.

At the end of each market, people with tickets will find out if they win the lottery. Each lottery ticket has a number on it, and the coordinator will draw a playing card from a shuffled deck for each lottery ticket. A red card (hearts or diamonds) means that ticket number 1 is a winner and is worth $1.00. A black card (clubs or spades), ticket number 1 is a loser and worth nothing. The pay out on each successive ticket will be determined in the same manner.

At the conclusion of each lottery, please fill out the remaining sections of the table.

Information in this market setting is strictly private. You will likely lose money by sharing your information with other market participants.

This is real money, yours to keep! You get to keep any money given to or earned by you during the course of the three markets. Payment will occur after market three.

Market _____

Starting money and ticket number	$1.25
How much money is a lottery ticket worth to you? (please enter an amount)	$
What is the price determined by the market? (will be given by coordinator after sheets are collected and handed back)	$
Did you buy a ticket? (check one)	____Yes ____No
How much money do you have left?	$
What ticket number did you buy? (enter number or check 'did not buy a ticket')	ticket no._____ did not buy a ticket____
Did your ticket win? (check one)	____one win ____no win
How much do I owe you for your ticket? (check one)	____$1.00 ____$0.00

Appendix B

Instructions to Sellers

Instructions for Sellers

You have a $.75 credit and a lottery ticket, and the opportunity to buy an additional ticket, or sell the ticket you have. This opportunity will occur three times, in short periods we will call 'markets.' At the beginning of each market, you will be asked how much your lottery ticket is worth to you. These tickets will pay out either $1.00 or $0.00, determined at the close of each period by a random card drawing. Whether any one ticket is a winner is independent of what happens with the other tickets.

In the second line on the table below, please write down how much a lottery ticket is worth to you. Don't fill in anything else yet! Raise your hand after you have done this. The exchange price of a ticket, which will be called the 'market price,' will be determined by assessing the values assigned to the tickets by all participants. The coordinator will tell you what the market price is after the values assigned to the tickets by all participants are collected. If the amount you value the ticket at is higher than the market price, you will buy an additional ticket at the market price. Otherwise, you will sell your ticket, and receive the market price and your money.

At the end of each market, people with tickets will find out if they win the lottery. Each lottery ticket has a number on it, and the coordinator will draw a playing card from a shuffled deck for each lottery ticket. A red card (hearts or diamonds) means that ticket number 1 is a winner and is worth $1.00. A black card (clubs or spades), means ticket number 1 is a loser and worth nothing. The pay out on each successive ticket will be determined in the same manner.

At the conclusion of each lottery, please fill out the remaining sections of the table.

Information in this market setting is strictly private. You will likely lose money by sharing your information with other market participants.

This real money, yours to keep! You get to keep any money given to or earned by you during the course of the three markets. Payment will occur after market three.

Market _____

Starting money and ticket number	$.75 ticket no._____
How much money is a lottery ticket worth to you? (please enter an amount)	$
What is the price determined by the market? (will be given by coordinator after sheets are collected and handed back)	$
Did you buy a second ticket? (check one)	____Yes ____No
How much money do you have left?	$
What ticket number did you buy? (enter number or check 'did not buy a ticket')	ticket no._____ did not buy a ticket____
Did your ticket(s) win? (check one)	____two win ____one win ____no win
How much do I owe you for your ticket(s)? (check one)	____$2.00 ____$1.00 ____$0.00

Appendix C

Risk Assessment Instrument

Would you prefer (a) or (b) in the following scenarios:

a. receiving $50
b. a 50% chance of receiving $150 and a 50% chance of receiving $0

a. receiving $60
b. a 50% chance of receiving $100 and 50% chance of receiving $40

a. receiving $50
b. a 50% chance of receiving $120 and a 50% chance of receiving $10

a. receiving $60
b. a 50% chance of receiving $120 and a 50% chance of receiving $0

a. receiving $60
b. a 60% chance of receiving $90 and a 50% chance of receiving $30

a. receiving $52.50
b. a 50% chance of receiving $100 and 50% chance of receiving $5

a. receiving $60
b. a 50% chance of receiving $100 and a 50% chance of receiving $0

a. receiving $70
c. a 50% chance of receiving $80 and a 50% chance of receiving $40

a. receiving $75
b. a 50% chance of receiving $120 and a 50% chance of receiving $8

Sex: Female Male

Age: _____

Appendix D

Complete Experimental Results

I. Wealth Effect Data: group 1
II. Wealth Effect Data: group 2
III. Endowment Effect Data: group 1
IV. Endowment Effect Data: group 2

group one								
Sellers	Beg. Mkt 1	Mkt 1	Beg. Mkt 2	Mkt 2	Beg. Mkt 3	Mkt 3	Ending We	Risk Level
1	0.75	0.6	3	0.51	4.5	0.51	5.15	3.5
2	0.75	0.38	2	0.6	3.5	0.6	4.15	2
3	0.75	0.75	1	0.75	3	0.85	2.35	0.5
4	0.75	0.75	3	0.75	5	1	5.35	1.5
5	0.75	0.01	2	0.25	3.5	0.5	4.15	2.5
6	0.75	0.5	2	0.51	3.5	0.65	3.85	1.5
7	0.75	0.5	2	0.5	3.5	0.75	4.85	1.5
8	0.75	1	1	0.75	1	0.5	1.65	3.5
9	0.75	1	2	1	4	1	4.35	0.5
10	0.75	0.5	2	0.75	4	0.25	4.65	5
11	0.75	0.25	2	0.5	3.5	1	3.85	2
12	0.75	1	1	0.75	1	0.76	0.35	3.5
13	0.75	0.5	2	0.75	3	1	2.35	2.5
Mean	0.75	0.595385	1.923077	0.643846	3.307692	0.720769	3.619231	2.307692
Std. Dev.	0	0.300517	0.640513	0.189012	1.164375	0.243942	1.164375	1.299655
Correlation				-0.23827		0.106183		-0.1553

group two								
Sellers	Beg. Mkt 1 Wealth	Mkt 1	Beg. Mkt 2 Wealth	Mkt 2	Beg. Mkt 3 Wealth	Mkt 3	Ending Wealth	Risk level
1	0.75	1	2	1.25	2.55	1.5	3.8	4.5
2	0.75	0.5	2	0.25	3.2	0.36	3.7	7.5
3	0.75	0.45	2	0.45	3.2	0.5	4.7	7.5
4	0.75	0.8	1	0.2	2.2	0.1	2.7	4.5
5	0.75	1	2	1	3.3	0.75	4.8	8.5
6	0.75	0.5	2	0.75	4.3	0.75	3.8	3
7	0.75	1	2	1	4.3	0.5	5.8	1.5
8	0.75	0.5	1	0	2.2	0.35	2.7	1
9	0.75	0	2	0.1	3.2	0.35	3.7	0
10	0.75	0.5	2	0.5	2.3	0.2	2.8	1.5
Mean	0.75	0.625	1.8	0.55	3.075	0.536	3.85	3.95
Std. Dev.		0.322533375	0.421637021	0.430116263	0.782180002	0.398140121	1.012422837	3.050045537
Correlation				0.551410967		0.183747766		0.28695905
Buyers	Beg. Mkt 1 Wealth	Mkt 1	Beg. Mkt 2 Wealth	Mkt 2	Beg. Mkt 3 Wealth	Mkt 3	Ending Wealth	Risk level
11	1.25	0.5	2	0.5	2.8	0	2.8	5
12	1.25	0.5	2	0.5	3.8	0	3.8	0.5
13	1.25	0.25	2.5	1	3.3	0.5	2.8	3.5
14	1.25	0.25	2.5	0.4	3.75	0.45	3.75	1.5
15	1.25	1	3	0.25	4.25	0	4.25	0.5
16	1.25	0.5	2	0.25	3.25	0.5	3.75	2
17	1.25	0.25	2.5	0.62	4.3	0.63	4.8	0
18	1.25	0.5	2	0.25	3.25	0.75	3.75	2
19	1.25	1	2	0	3.25	1.25	2.75	1
Mean	1.25	0.527777778	2.277777778	0.418888889	3.55	0.453333333	3.605555556	1.777777778
Std. Dev.		0.291666667	0.363241579	0.285632826	0.506211418	0.414547947	0.704647272	1.602948672
Correlation				0.256349581		-0.186145838		-0.718106669

group one								
mkt price	0.5	0.75	0.65					
Sellers	Mkt 1	Mkt 2	Mkt 3	Average	Risk level		Sex	Age
1	0.6	0.51	0.51	0.54	3.5		M	20
2	0.38	0.6	0.6	0.526666667	2		M	21
3	0.75	0.75	0.85	0.783333333	0.5		M	20
4	0.75	0.75	1	0.833333333	1.5		F	21
5	0.01	0.25	0.5	0.253333333	2.5		M	26
6	0.5	0.51	0.65	0.553333333	1.5		M	20
7	0.5	0.5	0.75	0.583333333	1.5		M	24
8	1	0.75	0.5	0.75	3.5		F	20
9	1	1	1	1	0.5		F	21
10	0.5	0.75	0.25	0.5	5		F	20
11	0.25	0.5	1	0.583333333	2		M	20
12	1	0.75	0.76	0.836666667	3.5		F	20
13	0.5	0.75	1	0.75	2.5		M	20
Mean	0.595384615	0.643846154	0.720769231	0.653333333	2.307692308			
Std. Dev.	0.300516649	0.189012277	0.243941986	0.194503166	1.299654787			
Covariance*	-0.017426036	-0.024260355	-0.207928994	-0.083205128				
Correlation*	-0.04833527	-0.106989518	-0.710497565	-0.356580439				
*between price and risk level								
Buyers	Mkt 1	Mkt 2	Mkt 3	Average	Risk level		Sex	Age
14	0.42	0.75	0.25	0.473333333	2.5		M	20
15	0.5	0.25	0.3	0.35	2.5		M	21
16	0.5	0.75	0.5	0.583333333	4		F	20
17	0.4	0.5	0.5	0.466666667	1.5		F	21
18	0.95	0.8	0.6	0.783333333	4.5		M	20
19	0.5	0.75	1	0.75	0.5		F	20
20	0.5	1	0.75	0.75	4.5		M	20
21	0.4	0.5	0.75	0.55	2.5		M	19
22	0.35	0.55	0.4	0.433333333	2		M	21
23	0.75	0.6	0.5	0.616666667	4.5		F	21
24	0.45	0.75	1	0.733333333	2.5		M	21
25	0.5	0.75	0.65	0.633333333	2.5		F	19
26	0.75	0.75	0.75	0.75	1.5		M	20
Mean	0.536153846	0.669230769	0.611538462	0.605641026	2.730769231			
Std. Dev.	0.173663394	0.186568197	0.236426386	0.143393945	1.284772753			
Covariance*	0.093579882	0.068639053	-0.064201183	0.032672584				
Correlation*	0.454370363	0.31021976	-0.228972264	0.192127025				
*between price and risk level								

group two								
mkt price	0.5	0.45	0.5					
Sellers	Mkt 1	Mkt 2	Mkt 3	Average	Risk level		Sex	Age
1	1	1.25	1.5	1.25	4.5		M	24
2	0.5	0.25	0.36	0.37	7.5		M	33
3	0.45	0.45	0.5	0.466666667	7.5		F	
4	0.8	0.2	0.1	0.366666667	4.5		F	22
5	1	1	0.75	0.916666667	8.5		F	21
6	0.5	0.75	0.75	0.666666667	3		F	21
7	1	1	0.5	0.833333333	1.5		F	22
8	0.5	0	0.35	0.283333333	1		M	22
9	0	0.1	0.35	0.15	0		M	40
10	0.5	0.5	0.2	0.4	1.5		M	23
Mean	0.625	0.55	0.536	0.570333333	3.95			
Std. Dev.	0.322533375	0.430116263	0.398140121	0.340059726	3.050045537			
Covariance*	0.32875	0.305	0.2503	0.294683333				
Correlation*	0.371314807	0.258324229	0.229021404	0.315683251				
*between price and risk level								
Buyers	Mkt 1	Mkt 2	Mkt 3	Average	Risk level		Sex	Age
11	0.5	0.5	0	0.333333333	5		F	23
12	0.5	0.5	0	0.333333333	0.5		M	26
13	0.25	1	0.5	0.583333333	3.5		M	21
14	0.25	0.4	0.45	0.366666667	1.5		F	22
15	1	0.25	0	0.416666667	0.5		M	21
16	0.5	0.25	0.5	0.416666667	2		M	31
17	0.25	0.62	0.63	0.5	0		M	21
18	0.5	0.25	0.75	0.5	2		M	22
19	1	0	1.25	0.75	1		F	22
Mean	0.527777778	0.418888889	0.453333333	0.466666667	1.777777778			
Std. Dev.	0.291666667	0.285632826	0.414547947	0.13540064	1.602948672			
Covariance*	-0.104938272	0.141419753	-0.119814815	-0.027777778				
Correlation*	-0.252510833	0.347484042	-0.202847033	-0.143982493				
*between price and risk level								

References

References

Arkes, H. R. and C. Blumer. "The Psychology of Sunk Costs." *Organizational Behavior and the Human Decision Processes* 35, 1 (1985): 124-140.

Brookshire, David S. and Don L. Coursey. "Measuring the Value of a Public Good: An Empirical Comparison of Elicitation Procedures." *The American Economic Review* 77 (September 1987): 554-566.

Coursey, Don L., John J. Hovis, and William D. Schulze. "The Disparity Between Willingness to Accept and Willingness to Pay Measures of Value." *Quarterly Journal of Economics* CII (August 1987): 679-690.

Franciosi, Robert, Praveen Kujal, Roland Michelitsch, Vernon Smith, and Gang Deng. "Experimental Tests of the Endowment Effect." *Journal of Economic Behavior and Organization* 30 (1996): 213-226

Kahneman, Daniel, and Amos Tversky. "Prospect Theory: An Analysis of Decision Under Risk." *Econometrica* 47 (March 1979).

Kahneman, Daniel, Jack L. Knetsch, and Richard H. Thaler. "Experimental Tests of the Endowment Effect and the Coase Theorem." *Journal of Political Economy* 98,6 (1990): 1325-1348.

Laughhunn, D.J., and J.W. Payne. "The Impact of Sunk Outcomes on Risky Choice Behavior." *INFOR (Canadian Journal of Operational Research and Informatin Processing)* 22 (1984): 151-181.

Rowe, Robert D., Ralph C. d'Arge, and David S. Brookshire. "An Experiment on the Economic Value of Visibility." *Journal of Environmental Economics and Management* 8 (1980): 1-19.

Staw, B.M., "Knee-deep in the Big Muddy: A Study of Escalating Commitment to a Chosen Alternative." *Organizational Behavior and Human Performance* 16 (1976): 27-44.

Thaler, Richard H. "Toward a Positive Theory of Consumer Choice." *Journal of Economic Behavior and Organization* 1 (March 1980): 39-60.

Thaler, Richard H., and Eric J. Johnson. "Gambling with the House Money and Trying to Break Even: The Effects of Prior Outcomes on Risky Choice." *Management Science* 36,6 (June 1990): 643-660.

van Dijk, Eric and Daan van Knippenberg. "Buying and Selling Exchange Goods: Loss Aversion and the Endowment Effect." *Journal of Economic Psychology* 17 (1996): 517-524.